Claims

1. A nucleic acid molecule encoding a polypeptide having the enzymatic activity of an RNA-directed RNA polymerase (RdRP) or encoding an enzymatically active fragment thereof selected from the group consisting of:
   (a) nucleic acid molecules coding for a polypeptide comprising the amino acid sequence given in SEQ ID NO: 2;
   (b) nucleic acid molecules comprising the nucleotide sequence given in SEQ ID NO: 1;
   (c) nucleic acid molecules hybridizing with a complementary strand of a nucleic acid molecule as defined in (a) or (b); and
   (d) nucleic acid molecules, the nucleotide sequence of which is degenerate as a result of the genetic code to a nucleotide sequence of a nucleic acid molecule as defined in (c).

2. The nucleic acid molecule of claim 1, which is DNA.

3. The nucleic acid molecule of claim 2, which is cDNA or genomic DNA.

4. The nucleic acid molecule of claim 1, which is RNA.

5. The nucleic acid molecule of any one of claims 1 to 4, which is derived from mammalian, plant, insect, worm, bacterial, or fungal cells or viruses.

6. The nucleic acid molecule of claim 5, wherein the plant is tomato.

7. A nucleic acid molecule of at least 15 nucleotides in length hybridizing specifically with a nucleic acid molecule of any one of claims 1 to 6 or with a complementary strand thereof.

8. A vector comprising a nucleic acid molecule of any of claims 1 to 6.

9. The vector of claim 8, wherein the nucleic acid molecule is operatively linked to regulatory elements permitting expression in prokaryotic and/or eukaryotic host cells.

10. A host cell comprising a vector of claim 8 or 9.

11. The host cell of claim 10, which is a bacterial, fungal, plant, insect, worm or mammalian cell.

12. A method for the production of a polypeptide having the enzymatic activity of an RNA-directed RNA polymerase or of an enzymatically active fragment thereof comprising culturing a host cell of claim 10 or 11 under conditions allowing the expression of said polypeptide and recovering the produced polypeptide from the culture.

13. A polypeptide encoded by a nucleic acid molecule of any one of claims 1 to 6, or produced by the method of claim 12.

14. The polypeptide of claim 14, which is phosphorylated.

15. An antibody specifically recognizing the polypeptide of claim 13 or 14.

16. An antagonist/inhibitor of the polypeptide of claim 13 or 14.

17. A method for identifying an antagonist/inhibitor of the polypeptide of claim 13 or 14 comprising:

(a) contacting the polypeptide of claim 13 or 14 with a plurality of compounds to be screened;

(b) determining whether said polypeptide is still capable of RNA directed RNA synthesis; and

(c) identifying the compound which inhibits the RNA directed RNA synthesis.

18. A method for determining whether a nucleic acid molecule is capable of serving as a template for RNA directed RNA synthesis comprising:

(a) contacting the polypeptide of claim 13 or 14 with a preferably single stranded nucleic acid molecule; and

(b) determining whether the complementary strand of said nucleic acid molecule is synthesized.

19. A pharmaceutical composition comprising a nucleic acid molecule of any one of claims 1 to 6, or a nucleic acid molecule which is complementary to such a nucleic acid molecule, a nucleic acid molecule of claim 7, a vector of claim 8 or 9, a polypeptide of claim 13 or 14, an antibody of claim 15, an antagonist/inhibitor of claim 16 preferably identified by the method of claim 17 and/or a template nucleic acid molecule determined by the method of claim 18, and optionally a pharmaceutically acceptable carrier.

20. A diagnostic composition comprising a nucleic acid molecule of any one of claims 1 to 6, or a nucleic acid molecule which is complementary to such a nucleic acid molecule, a nucleic acid molecule of claim 7, a vector of claim 8 or 9, a polypeptide of claim 13 or 14, an antibody of claim 15, an antagonist/inhibitor of claim 16 preferably identified by the method of claim 17 and/or a template nucleic acid molecule identified by the method of claim 18, and optionally suitable means for detection.

21. A kit comprising a nucleic acid molecule of any one of claims 1 to 6, the vector of claim 8 or 9 and/or the polypeptide of claim 13 or 14 or an enzymatically active fragment thereof.

22. A method for treating a disease which is caused by the undesired expression or overexpression of a nucleic acid molecule comprising administering a nucleic acid molecule of any one of claims 1 to 6, the vector of claim 8 or 9, and/or a polypeptide of claim 13 or 14 and preferably a template nucleic acid molecule derived from said nucleic acid molecule which causes the disease.

23. A method for treating a disease which is caused by the undesired expression or overexpression of a nucleic acid molecule comprising:

(a) obtaining cells from a mammal;

(b) introduction of a nucleic acid molecule of any one of claims 1 to 6 or a vector of claim 8 or 9 and optionally a template nucleic acid molecule derived from said nucleic acid molecule which causes the disease into said cells; and

(c) reintroducing the cells obtained as a product of step (b) into said mammal or into a mammal of the same species.

24. The method of claim 22 or 23, wherein said template nucleic acid molecule is determined by the method of claim 18.

25. The method of any one of claims 23 to 24 wherein the mammal is a human, rat or mouse.

26. The method of claim 23, wherein the cell is a germ cell, an embryonic cell or an egg cell or a cell derived therefrom.

27. A method for the production of a transgenic mammal comprising introducing a nucleic acid molecule of any one of claims 1 to 6 or a vector of claim 8 or 9 and optionally a template nucleic acid molecule into a germ cell, an embryonic cell or an egg cell or a cell derived therefrom.

28. A transgenic mammal comprising a nucleic acid molecule of anyone of claims 1 to 6 or a vector of claim 8 or 9 or obtained by the method of claim 27.

29. A transgenic plant cell comprising stably integrated into the genome

(a) a nucleic acid molecule of any one of claims 1 to 6 which is linked to regulatory elements allowing transcription and/or expression of the nucleic acid molecule in plant cells and/or

(b) a template nucleic acid molecule determined by the method of claim 18 which is linked to regulatory elements allowing transcription of said template nucleic acid molecule in plant cells.

30. A transgenic plant comprising plant cells of claim 29.

31. A transgenic plant cell which contains stably integrated into the genome a nucleic acid molecule of any one of claims 1 to 6 or a nucleic acid molecule of claim 7 which is linked to regulatory elements allowing transcription of said nucleic acid molecule in plant cells, wherein the presence of said nucleic acid molecules and/or the transcription and/or expression of the nucleic acid molecule of claim 7 leads to reduction of the synthesis of the polypeptide of claim 13 or 14 in the cells.

32. The plant cell of claim 31, wherein the reduction is achieved by an antisense, ribozyme and/or co-suppression effect.

33. A transgenic plant comprising the plant cells of claim 31 or 32.

34. A cultured plant tissue comprising plant cells of claim 29, 31 or 32.

35. Harvestable parts of a plant of claim 30 comprising cells of claim 29.

36. Harvestable parts of a plant of claim 33 comprising cells of claim 31 or 32.

37. Propagation material of a plant of claim 30, comprising cells of claim 29.

38. Propagation material of a plant of claim 33 comprising cells of claim 31 or 32.

39. Use of a nucleic acid molecule of any one of claims 1 to 6, or a vector of claim 8 or 9, or the polypeptide of claim 13 or 14 and/or the template nucleic acid molecule determined by the method of claim 18, for the preparation of a pharmaceutical composition.

40. Use of the nucleic acid molecule of claim 7 or the vector of claim 8 or 9, or the antibody of claim 15 and/or the antagonist/inhibitor of claim 16 for inhibiting RNA directed RNA synthesis.

41. The use of claim 40 for ensuring stable heterologous gene expression in transgenic organisms.

42. A transgenic mammalian cell comprising stably integrated into the genome

(a) a nucleic acid molecule of any one of claims 1 to 6 which is linked to regulatory elements allowing transcription and/or

expression of the nucleic acid molecule in mammalian cells and/or

(b) a template nucleic acid molecule determined by the method of claim 18 which is linked to regulatory elements allowing transcription of said template nucleic acid molecule in mammal cells.

43. A transgenic mammal comprising mammalian cells of claim 42.

44. A transgenic mammalian cell which contains stably integrated into the genome a nucleic acid molecule of any one of claims 1 to 6 or a nucleic acid molecule of claim 7 which is linked to regulatory elements allowing transcription of said nucleic acid molecule in mammalian cells, wherein the presence of said nucleic acid molecules and/or the transcription and/or expression of the nucleic acid molecule of claim 7 leads to reduction of the synthesis of the polypeptide of claim 13 or 14 in the cells.

45. The mamalian cell of claim 44, wherein the reduction is achieved by an antisense, ribozyme and/or co-suppression effect.

46. A transgenic mammal comprising mammalian cells of claim 44 or 45.

47. The transgenic mammal of claim 43 or 46 which is human, rat or mouse.

48. A transgenic plant or mammalian cells which contains stably integrated into the genome a nucleic acid molecule according to any one of claims 1 to 6 linked to regulatory elements which allow for expression of the nucleic acid molecule in plant or mammalian cells and wherein the nucleic acid molecule is foreign to the transgenic plant or mammalian cell and optionally a template nucleic acid molecule.

49. A method for testing a potential antagonist/inhibitor of the polypeptide of claim 13 or 14 comprising:

(a) contacting the polypeptide of claim 13 or 14 with a compound to be tested; and

(b) determining whether said polypeptide is still capable of RNA-directed RNA synthesis.

50. Use of the nucleic acid molecule of any one of claims 1 to 6, a vector of claim 8 or 9 and/or a polypeptide of claim 13 or 14 and, optionally, an appropriate RdRP template nucleic acid molecule for inhibiting expression of any desired gene by transferring the RdRP system to organisms that either lack a comparable mechanism or do not sufficiently express their own RdRP.

ADD B1 and 58